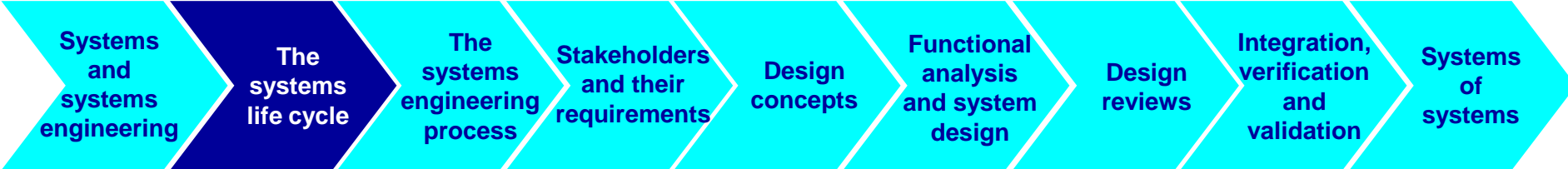


INTRODUCTION TO SYSTEMS ENGINEERING

Aurilla Arntzen, Ph. D. / Alberto Sols, Ph. D.

**Be attentive to all aspect of
lifecycle design**



**Systems
and
systems
engineering**

**The
systems
life cycle**

**The
systems
engineering
process**

**Stakeholders
and their
requirements**

**Design
concepts**

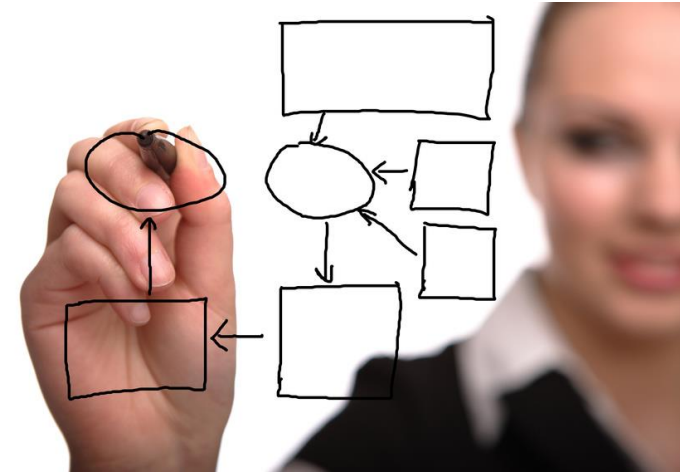
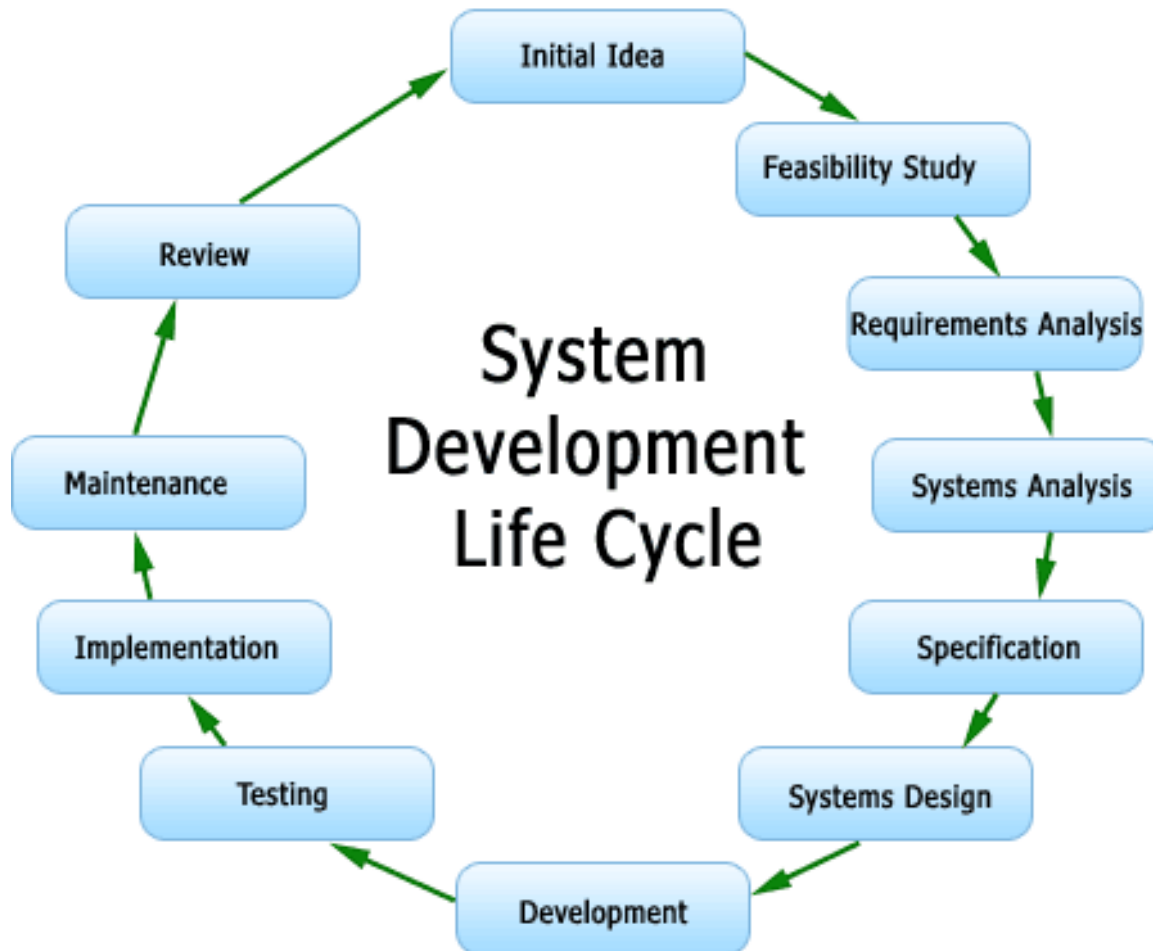
**Functional
analysis
and system
design**

**Design
reviews**

**Integration,
verification
and
validation**

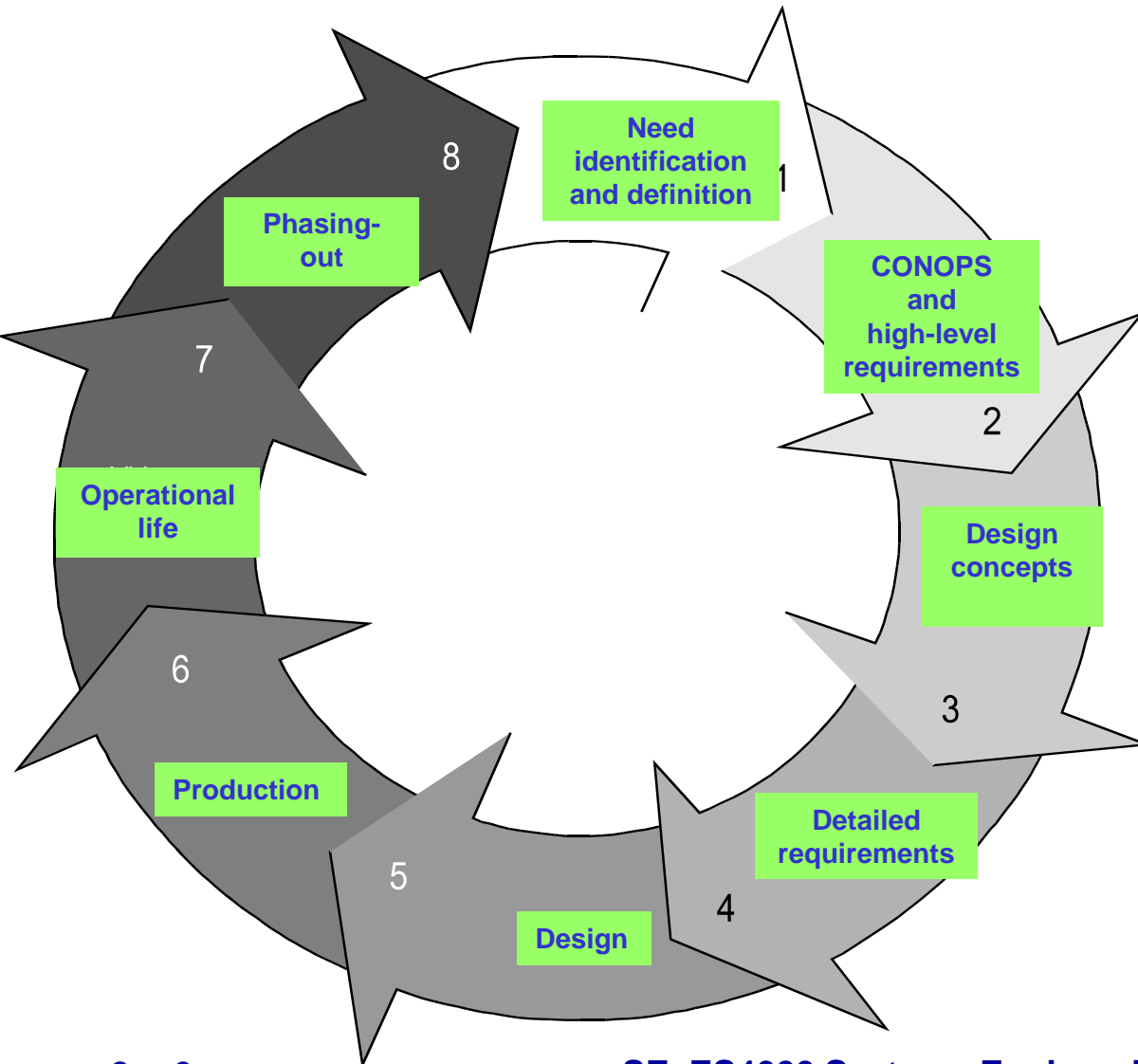
**Systems
of
systems**

The systems life-cycle



Various application domains → business information system. Health devices, defense, financial ,manufacturing, ect...

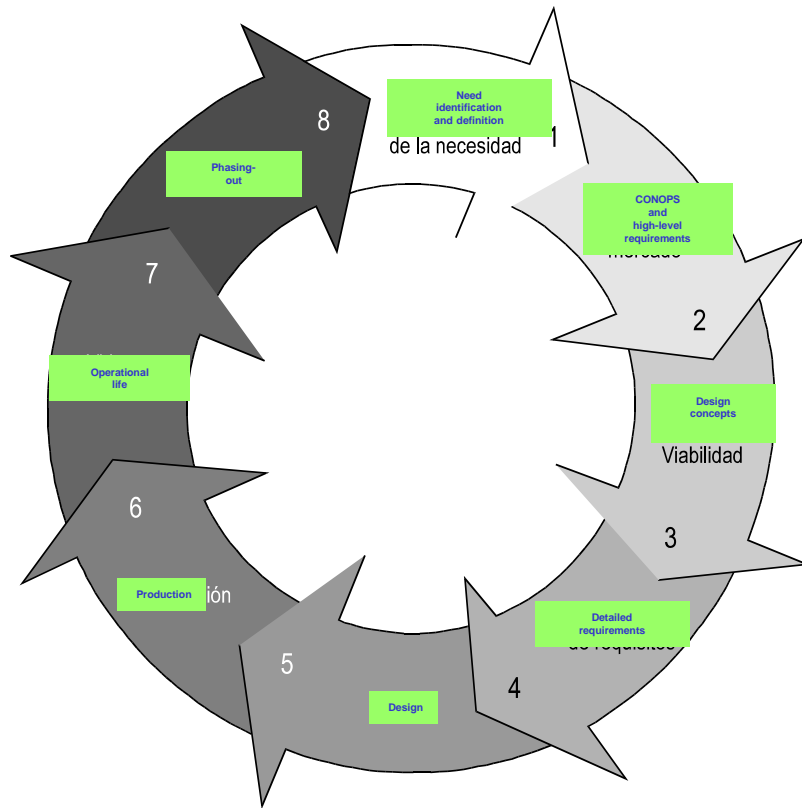
The systems life-cycle



A Concept of Operations (CONOPS) is a user-oriented document → describes systems characteristics for a proposed system from a user's perspective.

A **CONOPS** → user organization, mission, and objectives → to communicate overall quantitative and qualitative system characteristics to stakeholders

The systems life-cycle



- The identification of a need or market opportunity will trigger the life cycle of the system, which will end with its retirement (if the system is not consumed with its use).
- In between that identification of a need or opportunity and the eventual phasing out of the system, the life cycle is comprised by a series of phases.

Crisp vs Fuzzy boundaries

- Generally speaking, what has not been produced cannot be used; what has not been designed cannot be produced; what has not been **specified cannot be designed**
.....
- Nevertheless, there might be some overlap between boundaries of life-cycle phases (like detailed designed of certain subsystems done after production of part of the system has began).

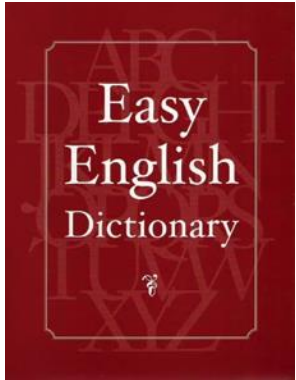
Fuzzy boundaries



- For example, the pressure hull of a submarine is constructed before the detailed design of some subsystems is completed.
- If commencement of production had to wait till design was fully complete, the design and development effort would take much longer, further complicating market and functional obsolescence problems.

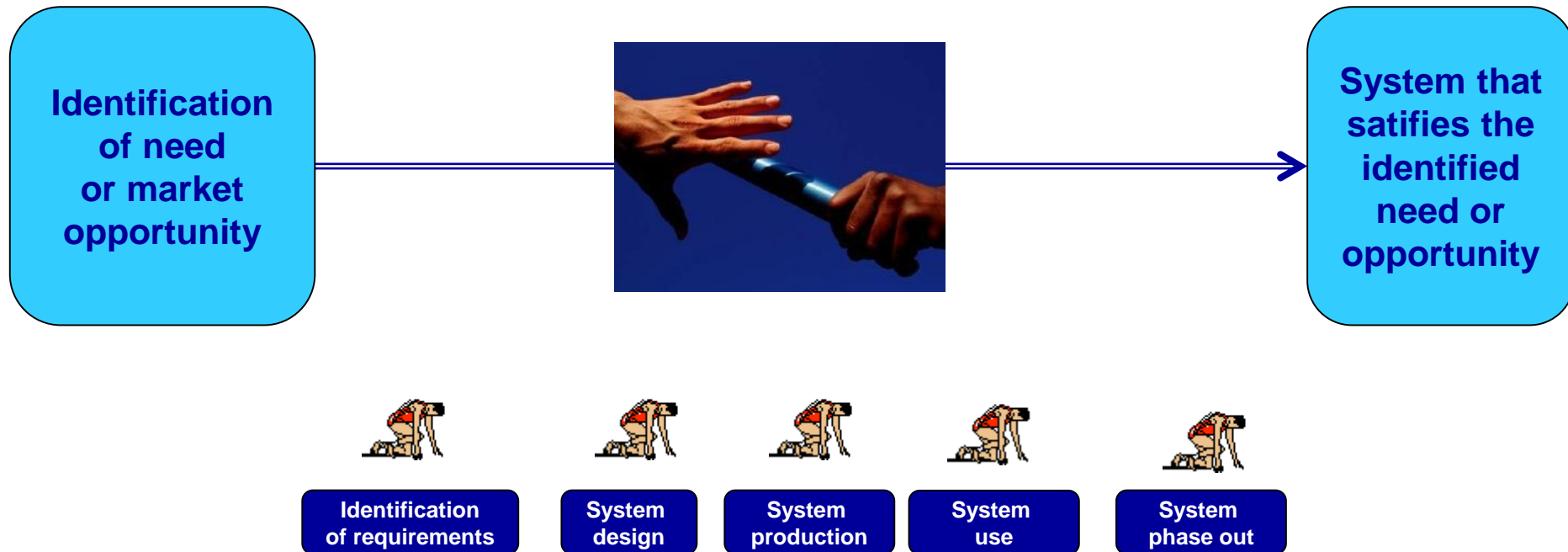


Analogy



***Analogy.* Similarity in some respects between things that are otherwise dissimilar.**

Analogy: the relay race



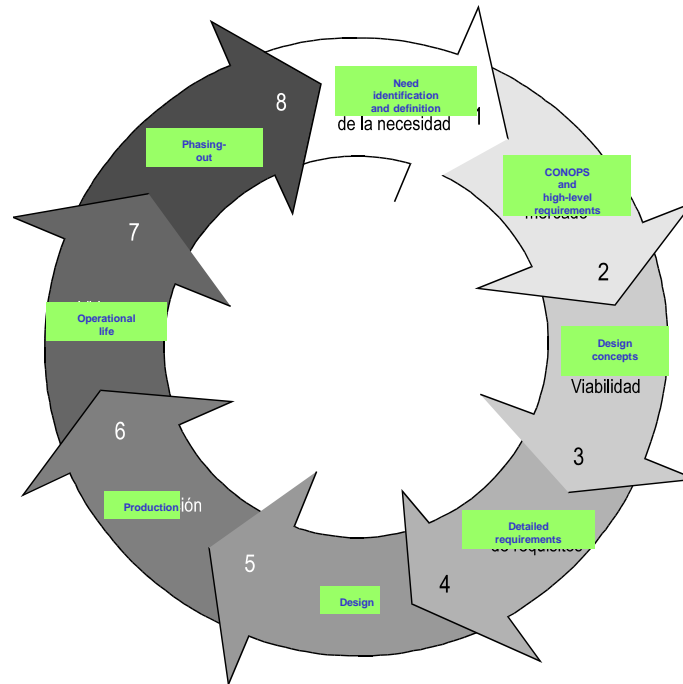
Phases are carried out sequentially, like in a relay race, in which each team member starts running after receiving the baton.

Analogy: the rugby team



Designs in a system are carried out in parallel, like in a rugby team, in which all team members run simultaneously and in a coordinated manner!

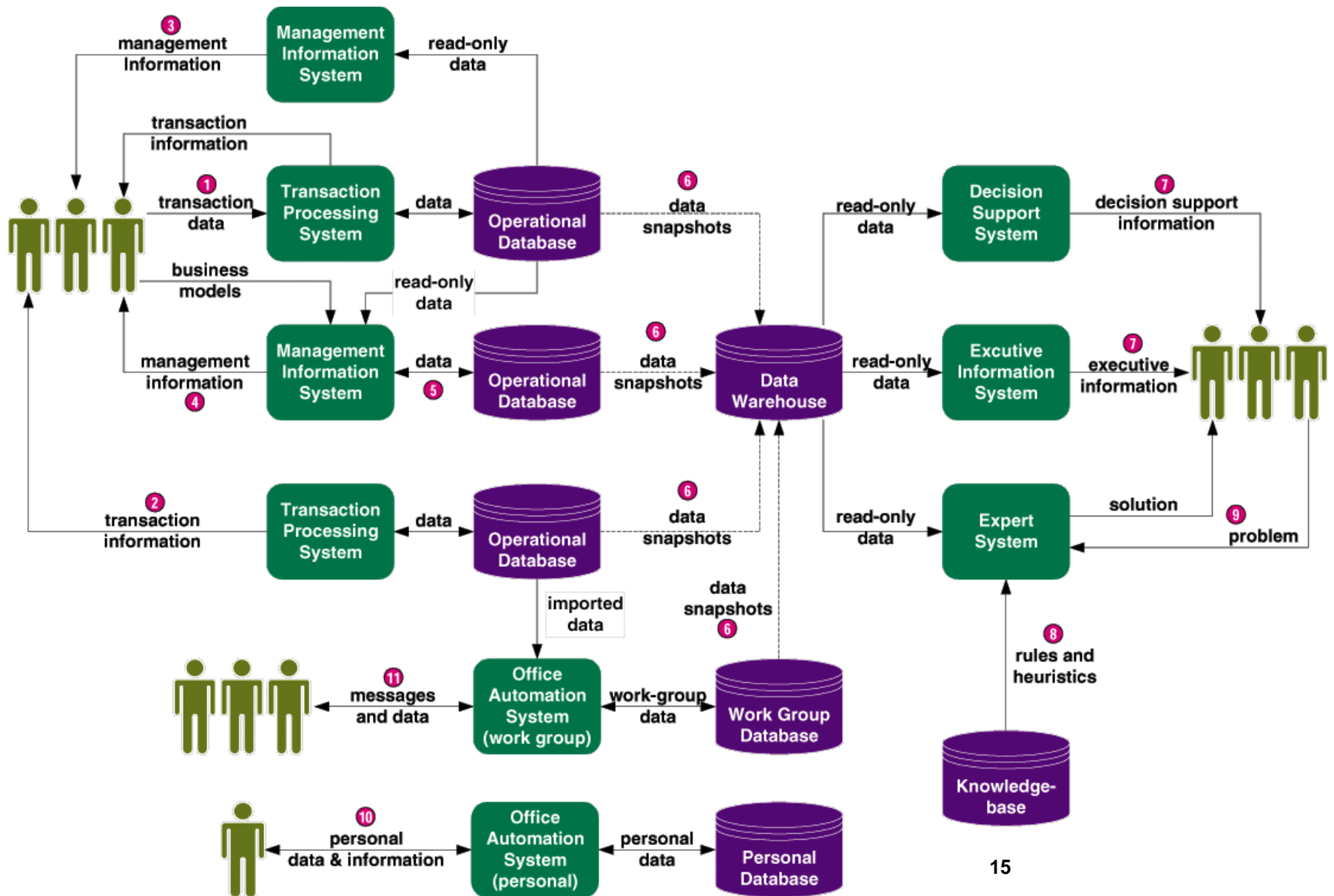
The systems life-cycle

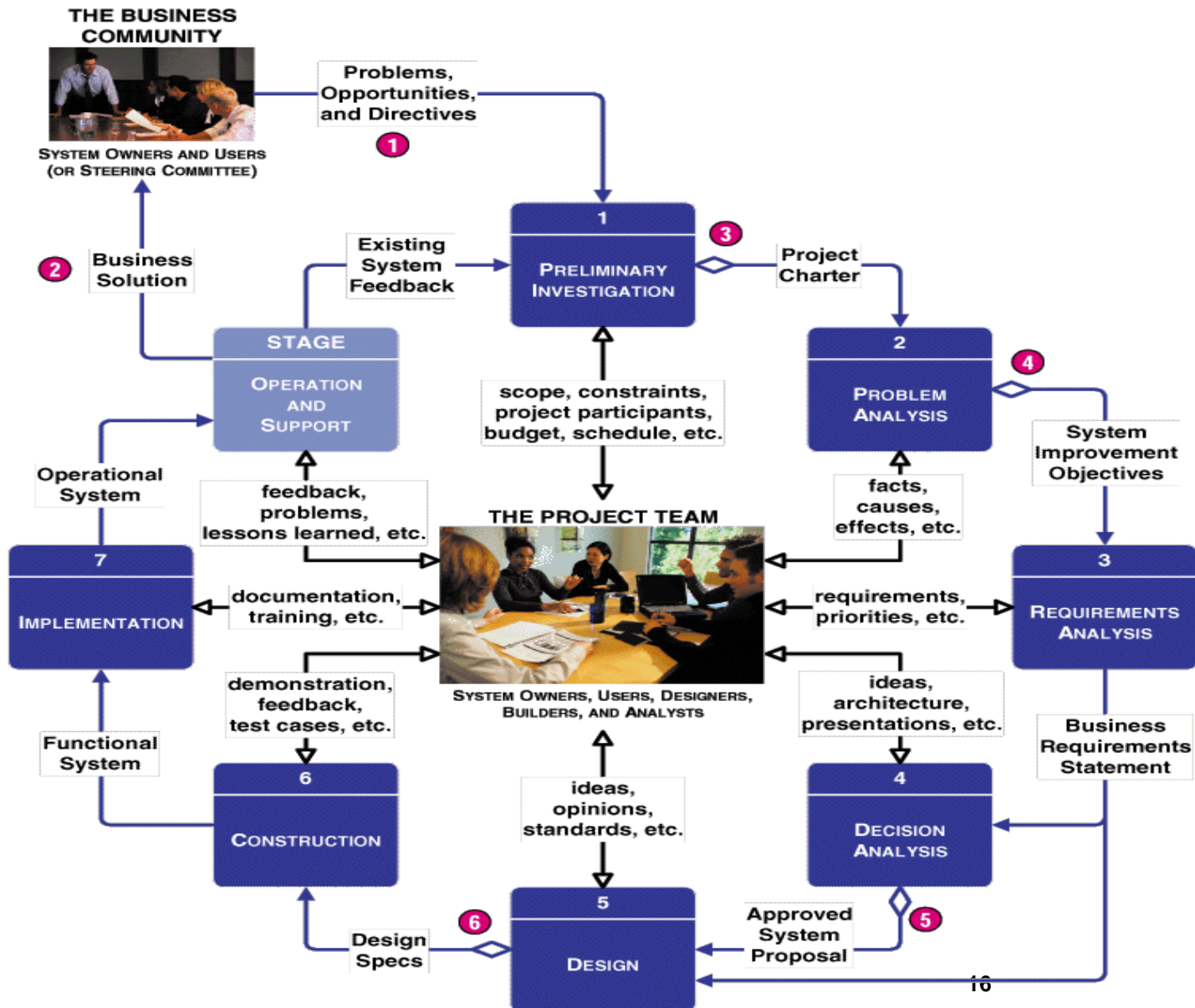


The phases of the system life-cycle are conducted sequentially, like in a relay race, but the design of the system and its associated processes of production, use, support and phase out are carried out in parallel, like in a rugby team.

Concurrent engineering

- **What has not been produced cannot be used; what has not been designed cannot be produced; what has not been specified cannot be designed**
- **Concurrent engineering (another discipline, in essence equal to systems engineering) is defined as the concurrent or simultaneous design of a system and its associated manufacturing, utilization, maintenance and phase-out processes.**
- **Whether we call it systems engineering, concurrent engineering, or simply GOOD ENGINEERING, the important thing is to maintain the global view!**





Systems Analysts role in a project

